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GB A 2165286 GB 0365197 US 3960399

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(58) Field of search

E1F

Selected US specifications from IPC sub-class E21B

## (54) Extracting broken tubes from boreholes

(57) A tube retracting device comprises a locating member (5) of a generally double conical form (18, 19) on which rest gripping arms (22) to engage inside a tube (3) lost in a hole (2). The arms (22) are pressure actuated against a spring bias (20) to force them outwards with a parallel motion. Pressure supplied through central passage 7 of pipe string 6 acts on cap 10 to move arms 22 over conical surface 19 which cams the arms 22 outwardly into gripping engagement with broken tube 3.

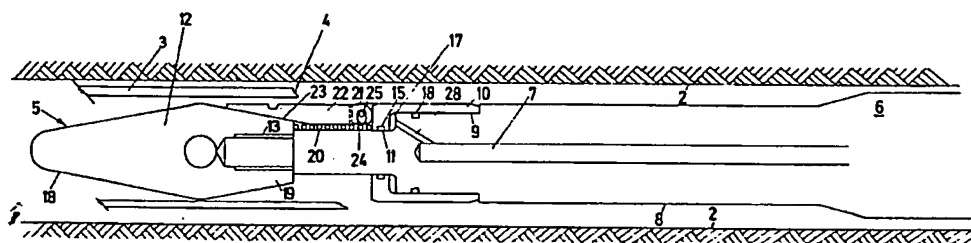
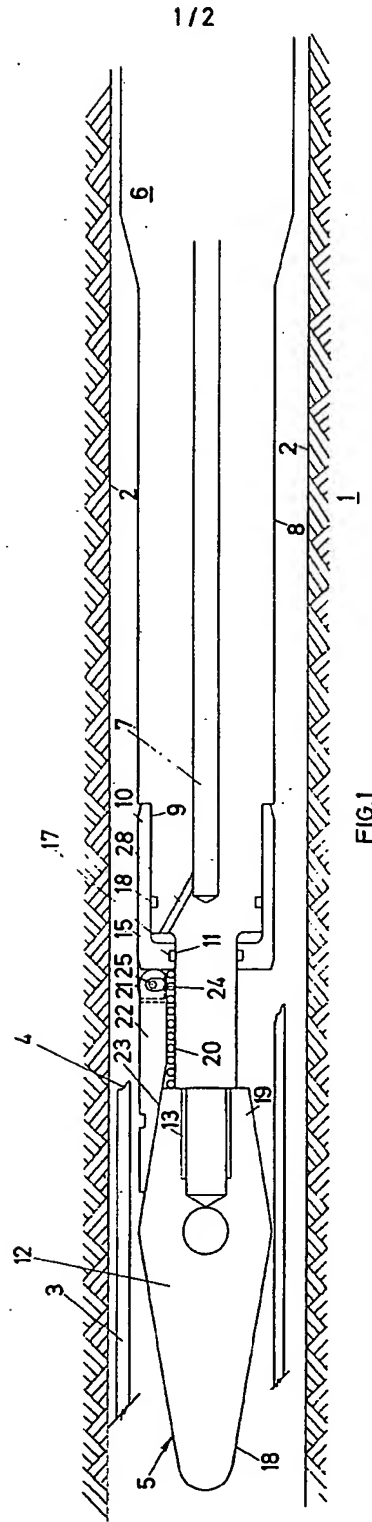


FIG.1

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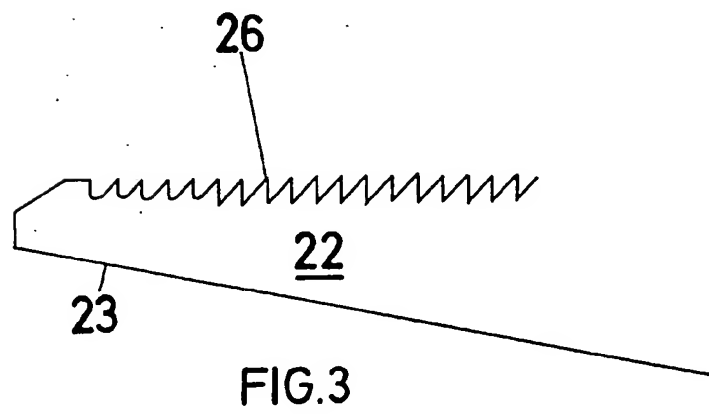
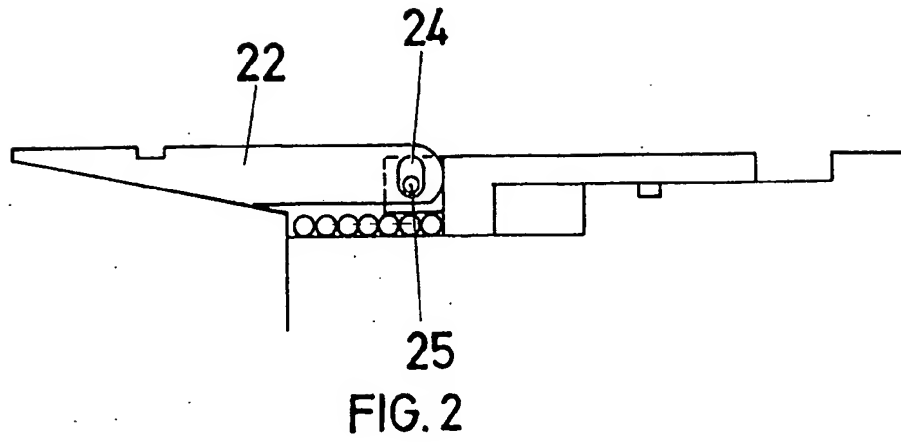
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## SPECIFICATION

## Tube retracting device

- 5 This invention relates to a tube retracting device and is particularly applicable for retracting a tubular element from a remote location.
- In many mining and quarrying installations it is necessary to drill holes either horizontally
- 10 vertically or inclined for various purposes including that of doing a natural gamma survey of a seam. In drilling the holes a drill string is rotated having a cutting head which bites into the face of the hole and the material cut from
- 15 the face is flushed up through the hole by a flushing fluid. The drill string is turned by a device situated outside the hole.
- In natural gamma logging of holes an instrument is passed down the hole on the end of
- 20 a carrier and in vertical holes this is normally a wire support. This wire support can also be used to send signals from the logging device up the shaft. However, if the hole is other than vertical it is necessary that the natural
- 25 gamma logging device is included at the end of a string and this string is usually of a tubular nature similar to the string used in connection with a drilling head. The logging device
- 30 logs the various parameters of the seam as it passes through the drilled hole and transmits the information back to a control source outside the hole.
- From time to time the hole is imperfect and occasionally the device will stick and pressure
- 35 has to be put on the drill string to move it forward or to retract it. Occasionally this pressure is such that the drill string will break and this can mean that an expensive device is left some distance from the front edge of the hole
- 40 and is not able to be readily retracted. To date the only way in which retraction has been possible has been to insert down the hole a serrated or helically scrolled conical end piece at the end of a drill string and to engage
- 45 the end of the broken device, which is normally tubular, and hopefully then retract the device. The use of a conical device has its disadvantages because it tends only to have an edge contact with the inside of the tubular
- 50 part projected backwards from the device and thus it is not always possible to get a satisfactory grip, particularly if the device is stuck fast.
- It is therefore an object of the present invention to provide an improved form of tube
- 55 retracting device which can be used with any tubular attachment on a drill head or logging head or other device which is stuck in a drill hole.
- 60 According to the present invention a tube retracting device for withdrawing a tube from a distant position includes a locating member adapted to locate inside the tube to be retracted, gripping means capable of being actuated
- 65 to engage the internal wall of the tube to

be withdrawn and means for applying a force to the gripping means to hold it in engagement with the internal wall of the tube whilst the tube is withdrawn.

- 70 The locating member is preferably of a general conical form so as to locate easily within the tube.
- Preferably the gripping means comprises a plurality of arms having serrations or knurled
- 75 or other rough surfaces on the areas adapted to engage the inside wall of the tube. Means are preferably provided to ensure that the gripping arms move parallel to the access of the tube and grip the inside of a tube over an
- 80 area. Preferably there is a minimum of three arms. The arms may be pivoted on a lost motion device to assist in the parallel movement.
- Biasing means may be provided on the device to bias the gripping means to a normal
- 85 position where they do not engage the wall of the tube.
- The means for applying force to the gripping means preferably comprises a fluid operated collar or piston. The fluid may conveniently be a drilling mud. Alternatively it could be a gas fluid or compressed air. This gas
- 90 could advantageously be an inert gas if the device is operating in an area which is expected to give off explosive gases.
- In order that the invention may be readily understood one example of a tube retracting device in accordance therewith will now be
- 100 described with reference to the three figures of the accompanying drawing. In the drawing figure 1 is a general cross-section view through a hole in a seam with the retracting device in position. Figure 2 is a detail showing the operation of the gripping means of the
- 105 device and figure 3 is a detail of the gripping means themselves.
- Referring now to the drawings it is assumed in this example that a horizontal hole has been drilled into the face of a coal seam and a
- 110 logging device has been inserted along the hole at the end of a tubular drill string in order to log seismically the characteristics of the strata through which the hole has been bored. The strata is indicated in figure 1 generally as
- 115 1 and the boundary of the hole is shown as 2.
- The end of a tubular drill string is indicated at 3 as a tube having a broken end 4 of the side towards the outside of the hole 2. The
- 120 retracting device 5 has been inserted into the hole 2 on the end of a drill string (not shown) and has been put into a position where its leading end has just located within the end of the broken tube 3.
- The device comprises an end member 6
- 125 having a tubular centre core 7. The end member 6 is connected to a tubular drill string (not shown). The end of the member 6 has a reduced portion 8 and the portion 8 is further
- 130 stepped down to an end at 9 so that a collar

10 can slidably fit over the end 9. The end 9 is further reduced at 11 and connects with a conical end piece 12 through a screwed projection 13.

5 As will be seen the collar 10 extends over the end 9 and on to the further reduced portion 11 and the collar 10 has a seal 15 rubbing over the portion 11 while the reduced portion 9 has a further seal 16. These seals 10 15 and 16 help to define a pressure area 17 between the collar and the end member 6 to which fluid can be pumped.

The conical end piece 12 comprises a front conical nose 18 and a frusto conical tapered rearward portion 19. In this example the degree of taper of the nose and the rearward portion is of the order of 10 degrees. The maximum dimension of the member 5 is such that it will easily fit within the wall of the tube 3.

20 A spring 20 biases the collar 10 away from the end 5. The collar 10 has attached to it lugs 21 (of which only one is shown) which carry gripping means in the form of arms 22 (of which only one is shown). In this particular example there are three arms spaced around the longitudinal axis of the device and as shown each arm 22 has a tapered front portion 23 which rests on the corresponding rearward portion 19 of member 5. In the position shown the maximum dimension of the arms in a radial direction is the same as that of the member 5. If reference is now also made to figures 2 and 3 it will be seen that 35 each arm 22 has a slot 24 which is engaged by a lost motion pivot 25 mounted in the lug 21. In figure 1 the arm 22 is shown in its unpressurised position whereas in figure 2 it is shown in its pressurised position and it will be noted that the arm has moved radially outward to the bottom of the slot 25. In figure 3 the surface of the arm 21 is shown with serrations 26 which are flame hardened and project in a rearward direction. These serrations 45 enable a good grip to be held on the inside of the tube 3.

A channel 28 connects the hollow fluid supply tube 7 with the pressure area 17.

50 In operation, with a logging device stuck in a hole and the drive tube having broken off at 4 the drill string is removed and the retracting device of the invention is secured by attaching the end member 6 to the end of a drill string. It will be known approximately where the position of the device is which has been lost 55 down the hole and the string is inserted with the retracting device on the end until it is in a position where the conical nose 18 of the member 5 will have located within the tube 3. 60 The conical nose assists in this location particularly if there are any burrs or jagged edges at the end 4. The member 5 is forced into the tube 3 for a distance so that the gripping arms 22 are located well within the tube 3. 65 Drilling mud is then pumped under pressure

down the hollow fluid tube 7 and passes through channel 28 into the pressure area 17. The pressure created within this area causes the collar 10 to move forward and as it does 70 so the front face 23 of each arm 22 slides over the inclined face of the rearward portion 19 and the arm moves radially outward due to the lost motion action of the pivot 25 in the slot 24. Each arm therefore moves from the 75 position shown in figure 1 to that shown in figure 2.

As the arms move outwards they engage with the inside of the tube 3 and the serrations 26 are forced by the pressure in the 80 area 17 to embed in the inner wall of the tube 3 and to make a good grip on it. On obtaining a secure grip the drill string is withdrawn and at this stage the fluid pressure is released.

85 The withdrawing action intensifies the radial grip of the arms by virtue of the conical end piece 12 sliding on the mating taper of the arms. This device has the effect of increasing the gripping force of the arms as the extraction force increases. 90

In the event of a need to relocate the device in the broken rod, fluid pressure is removed from the area 17 and the spring 20 biases the collar back to its original position as shown in Figure 1, the retracting device 95 can then be positioned as required.

It will thus be seen that a very effective means of withdrawing and rescuing a lost device having a tubular end has been provided 100 by the invention and one which is able to retract lost devices without any risk of damaging them or losing them during retraction.

#### CLAIMS

105 1. A tube retracting device for withdrawing a tube from a distant position includes a locating member adapted to locate inside the tube to be retracted, gripping means capable of being actuated to engage the internal wall of the tube to be withdrawn and means for applying 110 a force to the gripping means to hold it in engagement with the internal wall of the tube whilst the tube is withdrawn.

115 2. A device as claimed in Claim 1, in which the locating member is of a general conical form.

120 3. A device as claimed in Claim 1 or Claim 2, in which the gripping means comprises a plurality of arms having serrations or knurled or other rough surfaces on the areas adapted to engage the inside wall of the tube.

125 4. A device as claimed in any preceding claim and including means to ensure that the gripping arms move parallel to the access of the tube and grip the inside of a tube over an area.

130 5. A device as claimed in any preceding claim and including a plurality of arms substantially equally spaced around a common axis.

6. A device as claimed in Claim 5 and including at least three arms.
7. A device as claimed in Claim 3 or any claim dependent thereon in which the arms are pivoted on a lost motion device to assist in the parallel movement.
8. A device as claimed in any preceding claim and including biasing means provided on the device to bias the gripping means to a normal position where they do not engage the wall of the tube.
9. A device as claimed in any preceding claim in which the means for applying force to the gripping means comprises a fluid operated collar or piston.
10. A device as claimed in Claim 9 in which the fluid is a drilling mud.
11. A device as claimed in Claim 9 in which the fluid is a gas or air.
12. A device as claimed in Claim 11 which the gas is inert.
13. A tube retracting device substantially as hereinbefore described with reference to the accompanying drawings.

7. A device as claimed in Claim 6 in which the fluid is a drilling mud.

8. A device as claimed in Claim 6 in which the fluid is a gas or air.

70 9. A device as claimed in Claim 8 which the gas is inert.

10. A tube retracting device substantially as hereinbefore described with reference to the accompanying drawings.

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#### CLAIMS

Amendments to the claims have been filed, and have the following effect:

Claims 1 to 13 above have been deleted or textually amended.

New or textually amended claims have been filed as follows:

1. A tube retracting device for withdrawing a tube from a distant position includes a locating member adapted to locate inside the tube to be retracted, gripping means comprising a plurality of arms having serrations or knurled or other rough surfaces on areas adapted on actuation to engage the internal wall of the tube to be withdrawn, the arms including a lost motion device to ensure that the gripping arms move parallel to the axis of the tube and grip the internal wall of the tube over an area, and means for applying a force to the gripping means to hold it in engagement with the internal wall of the tube whilst the tube is withdrawn.
2. A device as claimed in Claim 1, in which the locating member is of a general conical form.
3. A device as claimed in either Claim 1 or Claim 2 and including a plurality of arms substantially equally spaced around a common axis.
4. A device as claimed in Claim 3 and including at least three arms.
5. A device as claimed in any preceding claim and including biasing means provided on the device to bias the gripping means to a normal position where they do not engage the wall of the tube.
6. A device as claimed in any preceding claim in which the means for applying force to the gripping means comprises a fluid operated collar or piston.